93-585 F

# CRS Report for Congress

# Theater Ballistic Missile Defense Policy, Missions and Programs: Current Status





Steven A. Hildreth
Foreign Affairs and National Defense Division



June 10, 1993



CRS

The Congressional Research Service works exclusively for the Congress, conducting research, analyzing legislation, and providing information at the request of committees, Members, and their staffs.

The Service makes such research available, without partisan bias, in many forms including studies, reports, compilations, digests, and background briefings. Upon request, CRS assists committees in analyzing legislative proposals and issues, and in assessing the possible effects of these proposals and their alternatives. The Service's senior specialists and subject analysts are also available for personal consultations in their respective fields of expertise.

Accession Number: 4634

Publication Date: Jun 10, 1993

Title: Theater Ballistic Missile Defense Policy, Missions and Programs: Current Status

Personal Author: Hildreth, S.A.

Corporate Author Or Publisher: Library of Congress, Congressional Research Service, Washington, DC
Report Number: 93-585F

Descriptors, Keywords: CRS Theater Ballistic Missile Defense Policy Mission Status TBMD TMD Persian Gulf War TBM ATBM

Pages: 00037

Cataloged Date: Aug 20, 1993

Document Type: HC

Number of Copies In Library: 000001

Record ID: 28047

# THEATER MISSILE DEFENSE POLICY, MISSIONS, AND PROGRAMS: CURRENT STATUS

## SUMMARY

Theater missile defenses (TMD) increasingly are an important national security priority. But interest in TMD is not a recent development. Throughout the 1980s, Congress urged the executive branch to pursue a vigorous program to counter the threat of Soviet short-range missiles in Europe. The result was mixed, and generally not to the satisfaction of Congress.

The end of the Cold War and the rise of new challenges, as evidenced by Iraqi missile attacks in the 1991 Persian Gulf war, brought new emphasis to U.S. TMD efforts. This new effort, which has overwhelming bipartisan support, is focused on addressing the threat arising from the global proliferation of missiles and weapons of mass destruction.

The military services have identified several TMD requirements: active defenses (theater missile interceptor systems, such as the Patriot); passive defenses (such as widely dispersing military assets); counterforce operations (such as directly attacking enemy missile launchers); and command, control, communications, and intelligence (a system to integrate and coordinate all TMD functions and theater military operations). These requirements form the four main elements of the TMD program. The Ballistic Missile Defense Organization (BMDO), formerly the Strategic Defense Initiative Organization (SDIO), is in charge of the entire TMD effort. The military services and other defense agencies largely fill a supporting role.

Most of the current TMD program is focused on developing active defense systems. Each of the four military services is pursuing interceptor programs designed for deployment in the near- and far-term. The immediate objective is to acquire some limited capabilities for addressing potential missile threats over the next several years. Additional, advanced TMD capabilities will be acquired later in this decade and beyond. Unexpected dramatic increases in the TMD budget and the surfeit of TMD programs suggest a critical review. Such a review might lead to significant budget savings.

The effectiveness of the rest of the TMD program is unclear. Currently, it is difficult to determine whether passive defense programs are receiving sufficient support or attention. The same could be said of counterforce initiatives within the services. In addition, questions can be raised over the priority that counterforce operations might be given in a future regional conflict by the theater commander. A critical review of these efforts may bring attention to key decisions that will have to be made.

## TABLE OF CONTENTS

# THEATER MISSILE DEFENSE POLICY, MISSIONS, AND PROGRAMS: CURRENT STATUS

## INTRODUCTION

Theater missile defenses (TMD), such as the Patriot system, are increasingly an important national security priority. Before the war against Iraq in early 1991, the spread of missiles and weapons of mass destruction throughout the Third World seemed an important, yet manageable problem. Iraq's missile attacks against Israel, Saudi Arabia, and U.S. forces proved that missile proliferation could present direct risks to U.S. forces and strategic interests. Hence, policymakers decided to develop and deploy effective theater missile defenses as a key element of a broader, growing commitment to counter proliferation.

The determination by Congress and the Clinton Administration to deploy effective TMD systems arises from many concerns. These include: 1) the proliferation of short-range missiles among nations hostile to U.S. interests; 2) fear over the potential spread of weapons of mass destruction (nuclear, chemical, and biological) that might be placed on those missiles; and, 3) the possibility that the United States or its allies might become engaged in conflicts where their vital interests may be put at risk by those missiles.

This report examines the rationale for developing theater missile defenses. It assesses the changed role of TMD today in the context of post-Cold War U.S. national security and foreign policy challenges. The report details the specific military requirements and describes the current organizational structure for TMD within the Department of Defense (DOD). Finally, this report describes the status of TMD programs and initiatives.

## RATIONALE FOR THEATER MISSILE DEFENSES

### TMD DEVELOPMENTS IN THE 1980s

During the 1980s, Congress sought a focused Pentagon effort to develop and deploy effective defenses against the possibility of Soviet short-range missile attacks against U.S. forces based in Europe. Gradually, the Pentagon and the Strategic Defense Initiative Organization (SDIO, now called the Ballistic Missile Defense Organization, or BMDO) shaped a TMD effort. But Congress remained doubtful that this effort was sufficient, given the Pentagon's predilection for strategic missile defenses. European interest in TMD was ambiguous, but a

small group of European leaders reaffirmed congressional views that TMD systems for deployment in Europe were warranted. Growing Israeli concerns also convinced many in Congress that theater missile defenses were needed for that key ally. These developments are explored below.

## Congressional Interest in TMD

In the 1950s and 1960s, the Army pursued a number of theater missile defense studies and programs.[1] It was not until the early 1980s, however, that serious congressional interest in TMD issues began. In 1982, the Army first requested funding for a joint military service theater missile defense research and development program.

Throughout the 1980s, Congress appeared frustrated with what it considered to be the Pentagon's unresponsiveness to TMD issues.[2] At first, Congress expressed disappointment with DOD's apparent lack of support for TMD as an appropriate response to the tactical missile threat in NATO Europe. After SDIO formed in early 1984, Congress often expressed frustration with the agency's seeming disinterest in TMD. For example, in a report on the FY 1991 defense bill, the House Appropriations Committee expressed alarm over the serious problems posed by the proliferation of tactical missiles among Third World countries. The committee added:

> Currently the Army and the Strategic Defense Initiative Office (sic) are pursuing separate and uncoordinated programs. SDI is funding new ground-launched programs such as ERINT, ERIS, THAAD, and Arrow. The Army is examining a new Hawk replacement missile and Patriot missile upgrades. It is not clear if the Navy and the Air Force are doing anything. The issue of command, control, and communications

---

[1] The Army's first antitactical missile (ATM) program, Plato, was started in 1951 and terminated in 1958. The next major program began in 1961 with FABMDS (Field Army BMD System), to which the requirement for air defense was added. FABMDS was phased out in 1963. Over the years, indecision and ambivalence characterized the Pentagon's response to TMD. The AADS-70 (Advanced Air Defense System) program followed FABMDS and was later replaced with the SAM-D (surface-to-surface missile defense). Both had a joint requirement for aircraft and antitactical missile defense. After the antitactical missile requirement for the SAM-D was dropped in the early 1970s, the program was renamed **Patriot**. See Davis, William A., Jr. Regional Security and Anti-tactical Ballistic Missiles. Washington, DC, Pergamon-Bracey, 1986. The Patriot would not acquire an ATM capability until the mid-1980s.

[2] See U.S. Library of Congress. Congressional Research Service. The Patriot Air Defense System and the Search for an Antitactical Ballistic Missile Defense. CRS Report No. 91-456F, by Steven A. Hildreth and Paul Zinsmeister, June 18, 1991. Washington, DC, 1991.

> of an integrated theater system has not yet been adequately addressed.[3]

The report later urged, in "a declining defense budget environment . . . the very serious issue of the tactical ballistic missile threat must be afforded a higher priority." This report typified the prevailing congressional view throughout the mid-to-late 1980s.

The legislative history for developing TMD systems also shows that although the House and the Senate agreed on the urgency of countering the growing theater missile threat, they differed on the appropriate response. Their concerns revolved around how best to proceed and who should manage the effort. During the early-to-mid-1980s, the House favored the deployment of a TMD system that exploited technologies being pursued in the newly formed SDI. The House preferred a system that was at least as capable as the newest generation Soviet air-defense missile (the SA-12). The Senate favored the potential near-term capabilities of the Patriot air-defense system and looked to SDIO for a longer term solution to the tactical and theater missile threat. The House too supported Patriot as a likely candidate for NATO's air defense modernization effort.

In 1987, Congress settled on a plan to develop and deploy TMD systems. Congress directed that near-term deployment and long-term development of TMD systems should be split, giving the Army and SDIO those respective responsibilities.[4] The Army then focused its efforts toward giving the Patriot air-defense system a self-defense capability against theater missile attacks. Meanwhile, the SDI Organization pursued more advanced technical solutions such as ERINT, THAAD, and the Israeli Arrow program (detailed later in this report).

In 1990, however, Congress remained unsatisfied. Therefore, it directed that the Secretary of Defense establish a new Tactical Ballistic Missile Defense effort that would include all TMD programs.[5] Secretary Cheney gave this management responsibility to SDIO, which in turn established a new deputy director for TMD programs. Shortly thereafter, the war against Iraq convinced many that effective missile defense systems were necessary to U.S. national security and foreign policy interests. Congress therefore established the 1991

---

[3] U.S. Congress. House. Committee on Appropriations. Department of Defense Appropriations Bill, 1991. Report No. 101-822 to accompany H.R. 5803. Washington, G.P.O., 1990. pp. 178-179.

[4] See section 217(a) of the National Defense Authorization Act for Fiscal Years 1988 and 1989. P.L. 100-180 (101 STAT 1052).

[5] U.S. Congress. House. Committee of Conference. Making Appropriations for the Department of Defense. Report No. 101-938 to accompany H.R. 5803. Washington, G.P.O., pp. 117-118. $218 million was appropriated for this program.

Missile Defense Act, which gave DOD its strongest TMD mandate to date. The Act states:

- It is a goal of the United States to . . . provide highly effective theater missile defenses to forward-deployed and expeditionary elements of the Armed Forces of the United States and to friends and allies of the United States.

- The Secretary of Defense shall aggressively pursue the development of advanced theater missile defense systems, with the objective of downselecting and deploying such systems by the mid-1990s.

Once again, Congress remained concerned over SDIO's management of the TMD mandate it believed it had given the executive branch. In 1992, Congress established a new Theater Missile Defense Initiative (TMDI), where all theater and tactical missile defense activities of the Defense Department were to be carried out.[6] In December 1992, Defense Secretary Cheney placed the TMDI under the management and direction of the Director of SDIO.

Congress now awaits key TMD decisions by President Clinton. During the Presidential campaign, Candidate Clinton's views toward missile defenses appeared to parallel those of the Congress. Indeed, shortly after taking office, Defense Secretary Aspin ordered a budget review of the SDI program, giving TMD programs first priority. The TMD program emphasis is reflected in the Clinton Administration's FY 1994 defense budget request, as well as in the planned budget through this decade. Currently, there are no plans to remove TMD from BMDO. It is unclear whether Congress will continue to seek to direct or further shape the management of TMD programs.

**Reagan and Bush Administrations**

Unlike Congress, the Reagan and Bush Administrations emphasized strategic missile defense research and development at the expense of TMD initiatives. This section reviews the evolution of Reagan and Bush rationales toward missile defenses.

On March 23, 1983, President Reagan delivered a nationwide address in which he spoke of a long-term national security goal to eliminate "the threat posed by strategic nuclear missiles," and to render such weapons "impotent and obsolete."[7] This address, popularly known as the President's "Star Wars"

---

[6] See section 231 of the National Defense Authorization Act for Fiscal Year 1993. P.L. 102-484 (106 STAT 2315). The Act authorized up to $935 million for TMD research, development, testing, and evaluation.

[7] Address to the Nation on Defense and National Security, March 23, 1983. Public Papers of the President. Ronald Reagan. Book 1, Jan. 1 - July 1, 1983. Washington, G.P.O., pp. 437-443.

speech, prompted several studies.[8] In turn, a major technology research program called the Strategic Defense Initiative was launched.[9] In his "Star Wars" speech, President Reagan included the defense of U.S. allies as a priority. To many Europeans, this point appeared to have been mentioned as a *pro forma* afterthought.[10] Other policy directives made it clear, though, that SDI would include the defense of U.S. allies against nuclear and conventionally armed missiles of all ranges.[11] The Administration directed that the entire initiative be compliant with U.S. treaty obligations, in particular the 1972 ABM Treaty.[12]

In 1985, Defense Secretary Caspar Weinberger directed SDIO to explore ways in which SDI could assist the NATO extended air-defense effort. (At the time this was a proposed, significant expansion and modernization.) Further guidance from both the U.S. Army and the Joint Chiefs of Staff (JCS) followed Secretary Weinberger's directive. Specific, classified mission and operational requirements were then established by the Joint Chiefs of Staff for TMD. These

---

[8] Two days after his speech, President Reagan issued a National Security Directive (NSDD) addressing his intent "to direct the development of an intensive effort to define a long-term research and development program aimed at an ultimate goal of eliminating the threat posed by nuclear ballistic missiles .... consistent with our obligations under the ABM Treaty and recognizing the need for close consultations with our allies." See White House Announcement on the Development of a Defensive System Against Nuclear Ballistic Missiles. March 25, 1983. Ibid., pp. 458-459.

[9] On January 6, 1984, Reagan signed another NSDD (No. 119), calling for "initiation of a focused program [the SDI] to determine the technical feasibility of enhancing deterrence . . . through greater reliance on defensive strategic capability .... [and moving] technology to a point where a decision could be made" on whether to deploy an SDI system. See Getler, Michael. Reagan Signs Anti-Missile Research Order. The Washington Post, January 26, 1984, p. A1.

[10] See U.S. Library of Congress. Congressional Research Service. The SDI and U.S. Alliance Strategy. CRS Report No. 85-48F, by Paul Gallis, Mark Lowenthal, and Marcia Smith, Feb. 1, 1985. Washington, DC, 1985.

[11] See, for example: The President's SDI. White House. January 1985. p. 6. NSDD 172 (May 31, 1985) directed that cost-effective approaches be found to defend the U.S. and allies against nuclear ballistic missiles of all ranges.

[12] The 1972 ABM Treaty restricts the testing and deployment of missile defense systems and components that have demonstrated the capability "to counter strategic ballistic missiles or their elements in flight trajectory." See Treaty Between the United States of America and the Union of Soviet Socialist Republics on the Limitation of Anti-Ballistic Missile Systems. Article II. Thus, while most agree that TMD systems not tested against "strategic ballistic missiles or their elements" are not constrained by treaty, there remains considerable uncertainty over exactly what constitutes a strategic ballistic missile.

policy directives established the Pentagon's basis for pursuing TMD policy and programs.

Many observers, however, believed this effort was inadequate because there was no corresponding increase in TMD program or funding support. Some also believed the Pentagon's rationale was unfocused; it did not clearly support the necessity for TMD systems in U.S. military plans. Since the mid-1980s, congressional action would produce an ever increasing Pentagon budget and support for TMD programs. The Pentagon did not oppose these actions.

**Western Europe and NATO**

As a backdrop to growing U.S. interest in TMD, it is useful to review developments in Europe. To some extent, during the 1980s, the small vocal support for TMD in Europe reinforced congressional support of TMD. Current European perspectives toward TMD now seem to parallel the changing U.S. rationale for deployment of effective TMD systems at the earliest date possible to counter the global proliferation of missiles and weapons of mass destruction.

As U.S. interest in TMD grew in the 1980s, West European views toward the SDI program and TMD began to soften. Partly because they were not consulted before Reagan's "Star Wars" speech, nearly all U.S. allies initially viewed the advent of SDI with alarm. Europeans voiced concerns that SDI might contribute to a decoupling of U.S. and West European security, lead to abandonment of offensive nuclear deterrence, upset U.S.-Soviet relations, as well as challenge Europe economically as the United States pursued a vigorous advanced technology program with potentially significant commercial applications. The allies remain wholly opposed to any BMD research, testing, or deployment that would threaten continued U.S.-Russian commitment to the ABM Treaty. There is broad support for treaty-compliant research, development, and testing, however. This is especially true for TMD, which many Europeans now view potentially as meeting genuine security concerns against the threat of global proliferation.

Shortly after SDIO was formed, the United States courted, with mixed success, West European support for SDI. In 1985, Secretary Weinberger solicited allied participation in the SDI program ostensibly to bring in additional technical expertise. While some countries joined formally in the SDI effort, most West European allies chose not to participate. Private companies in most countries were largely free to enter into contract with SDIO without the need for formal government support.[13] However, many West European leaders

---

[13] The cumulative amount of foreign participation is detailed in U.S. Library of Congress. Congressional Research Service. The Strategic Defense Initiative: Issues for Congress, by Steven A. Hildreth. CRS Issue Brief 85-157. Washington, DC, updated regularly. Much of the allied contribution to SDI came by way of TMD analyses to determine system requirements. There were also a number of minor technology initiatives. The largest recipient was Israel, which has received about 60 percent of all money awarded to foreign contracts.

apparently viewed Secretary Weinberger's offer as a sop to buy political support for SDI. To date, only a tiny portion of the total BMD budget has been awarded to foreign countries.[14]

West European interest in developing TMD began to grow among a small group of defense specialists and decisionmakers. In 1985, then West German Defense Minister Manfred Woerner urged NATO to examine its air-defense modernization efforts more seriously. Woerner wanted to develop TMD capabilities to counter Warsaw Pact short-range missiles. Woerner's proposal ran into stiff resistance throughout NATO Europe.

Woerner's call for an antitactical ballistic missile system, as part of an alliance-wide "Extended Air Defense" program, was supported by NATO's Supreme Allied Commander, General Bernard Rogers, in early 1986. General Rogers endorsed TMD as part of a broad NATO effort to defend alliance members against short- and medium-range missiles armed with conventional and mass destruction warheads. In particular, General Rogers cited the growing threat from Soviet intermediate-range nuclear missiles (since eliminated by the INF Treaty[15]), and the newer generation of Soviet shorter range missiles (the SS-21 and SCUD, since eliminated by the Bush-Gorbachev initiatives of 1991[16]). NATO defense ministers later endorsed Extended Air Defense as the conceptual framework for a European-based TMD system. Various NATO defense studies highlighted the advantages of deploying TMD systems for Europe.[17]

---

Israel has worked on TMD-related analyses and is pursuing the Arrow interceptor program.

[14] SDIO awarded about 2 percent of its entire budget from FY 1985 through FY 1993 to foreign countries and contracts. See Ibid.

[15] The Intermediate-Range Nuclear Forces Treaty (signed December 8, 1987) required the destruction of all U.S. and Soviet ground-launched ballistic and cruise missiles with ranges of between 500 and 5,500 kilometers, their launchers and associated support structures and equipment. This task was completed in 1991.

[16] See U.S. Library of Congress. Congressional Research Service. Nuclear Weapons in the U.S. Force Structure: Fact Sheet on the President's September 27 Proposals, by Amy Woolf. CRS Report No. 91-715F, October 3, 1991, and U.S. Library of Congress. Congressional Research Service. Nuclear Arms Control After START, by Amy Woolf and Steven A. Hildreth. CRS Issue Brief 92-148F, updated regularly.

[17] Many believed that a TMD system for NATO Europe could serve a number of military purposes. TMD would: 1) provide some protection of population centers and reserve forces in a conflict; 2) deny the Soviet's the ability to benefit from a massive conventional attack by defending key offensive retaliatory assets, munitions sites, and critical command and control installations; 3) help NATO

Opponents made compelling arguments against TMD for Western Europe. Their arguments revolved around skepticism of the military utility of TMD,[18] the irrelevance of TMD after the signing of the 1987 INF Treaty, concerns over TMD's cost and affordability, and the rise of a reform-minded Soviet leadership.

The threat of potential missile attacks from hostile Third World nations in North Africa and the Middle East apparently have generated renewed interest in TMD. Several European countries have purchased U.S. Patriot missile defense systems. Several are looking ahead to more effective TMD systems. Also, some indigenous European TMD programs are under development.[19]

**Israel**

Only recently, after the 1991 war against Iraq, has the United States determined that TMD systems were necessary to deal with the threat of global missile proliferation. Israel reached this conclusion much earlier, in the mid-to-late 1980s. Israel's concerns thus served to forewarn U.S. decisionmakers of the utility of TMD for Third World missile threats.

For many years, Israel was concerned about the transfer of Soviet short-range Scud-B and SS-21 missiles to Syria because a state of war still exists technically between the two countries. Israel has also expressed alarm about the extent to which missiles have been transferred to other countries such as Egypt, Libya, Iraq, Iran, Saudi Arabia, and Yemen. In a few of these countries, there have been additional efforts to acquire weapons of mass destruction.

The Israelis have also witnessed a strong willingness on the part of some of their regional neighbors to use missiles as an instrument of terror and warfare. Several regional conflicts illustrate this point: the 1973 Yom Kippur War between Egypt and Israel (both sides attacked each other with missiles);

---

achieve a dominant position of control at every level of escalation in a crisis, thus hopefully deterring nuclear conflict by providing the Soviets the choice of war-termination or escalation; 4) deny the Soviets any theater victory in Europe and the ability to predict the outcome of any attack on NATO.

[18] Critics pointed to the variety of countermeasures (e.g., warhead decoys and chaff) by which a TMD system could be defeated by the Soviets, as well as by overwhelming a defense system with numerous ballistic and cruise missiles.

[19] The German Air Force, for example, plans to replace its Hawk air-defense system around the year 2000 with a highly mobile air and tactical missile defense system called TLVS. The TLVS concept phase began in 1987 and was completed in 1991. Like the Patriot system, the TLVS would use a fragment warhead to destroy its target. A French-Italian program called SAMP/T (Sol-Air Moyenne Portee/Terrestre) is being considered for a point defense system; further development may give it an extended area defense capability. Some proponents estimate this system could be deployed in ten years at a cost of $5 - $9 billion.

over 2,000 Afghan Army rocket and missile attacks were launched against the *mujaheddin* in 1988-1989; and over 600 rocket and missile attacks occurred between Iran and Iraq in their long war of attrition in the 1980s. Israel witnessed this firsthand during the 1991 Persian Gulf War when it was attacked by almost 50 Iraqi Scud missiles.

It was not until the mid-to-late 1980s, however, that Israel began to consider seriously the possibility of developing and deploying TMD systems as a potential response to the threats of missile attacks. Previously, the Israelis considered the threat of offensive military operations as the only realistic option it had to prevent missile attacks or to minimize damage to their military control centers, storage depots, air bases, and cities.

Apparently, the catalytic event for considering TMD as a realistic military option took place in 1985 when Secretary Weinberger invited foreign participation in the SDI program.[20] Israel's first SDI contracts focused on identifying the theater missile threat and defining the need for a Middle East missile defense system. These studies were soon followed by a joint U.S.-Israeli initiative to develop a new TMD system called Arrow. (The Arrow program is detailed later in this report.) In the wake of the Persian Gulf war, the need for an effective near-term TMD system is a national security priority for Israel. Meanwhile, Israel relies on Patriot to fill what it believes is only an interim role as it anticipates acquiring a more capable TMD system.

## CHALLENGES IN THE POST-COLD WAR ERA

The rationale for TMD to help defend NATO Europe in case of a Soviet conventional war is no longer compelling. With the demise of the Soviet Union and the easing of the superpower confrontation and rivalry of the Cold War, the United States faces new challenges to its global interests. New security challenges actually increase the importance of TMD to the United States to counter the proliferation of missiles and missile technologies, as well as the spread of weapons of mass destruction to countries hostile to U.S. interests. The 1991 war against Iraq illustrated a number of other national security challenges to military planners. As the sole remaining superpower, the United States faces foreign policy challenges in seeking to avoid being drawn unnecessarily into regional crises where missile proliferation could threaten U.S. forces and interests. It is not likely that complete avoidance will be possible in all instances, however. For each of these challenges, TMD offers technical feasibility and political viability to the difficult challenges that lie ahead.

### Global Proliferation

Bush Administration assessments over the past few years suggest a worrisome future where proliferation of missiles and weapons of mass

---

[20] Interviews with Israeli officials in Washington, D.C., July 1989.

destruction threaten a range of U.S. and global interests. In 1991, Defense Secretary Cheney wrote to Congress:

> Of grave concern is the proliferation of nuclear weapons and the means to deliver them. By the year 2000 it is estimated that at least 15 developing nations will have the ability to build ballistic missiles, 8 of which either have, or are near to acquiring nuclear capabilities. Thirty countries will have chemical weapons and ten will be able to deploy biological weapons as well.[21]

In late 1992, the SDI Organization released a lengthy report on global missile proliferation.[22] The report concludes that nineteen developing countries have either ballistic missiles in development or possess operational missiles.[23]

The SDIO report further states that among the developing nations, six have chemical weapons programs (Burma, Chile, Egypt, Israel, Pakistan, and Vietnam), two have biological weapons programs (Brazil and Argentina), and nine have both (India, Iran, Iraq, Libya, North Korea, South Africa, South Korea, Syria, and Taiwan). Fifteen developing countries are identified as having nuclear programs or supporting nuclear research and development.[24]

It has been pointed out, however, that the spread of missiles in the developing world "doesn't mean those missiles will have the range to reach the United States. Nor does it mean that those countries will see any reason to threaten U.S. interests."[25] Many of the countries cited in the SDIO report on

---

[21] See Secretary of Defense. Annual Report. January 1991. pp. ix-x. Cheney's statement followed a similar assessment by the Director Gates of the Central Intelligence Agency.

[22] See, Strategic Defense Initiative Organization. Ballistic Missile Proliferation: An Emerging Threat. December 1992. Washington, DC. p. 11. Various reports describe categories, types, and ranges of ballistic missiles. Many of these reports do not agree with each other.

[23] The countries identified in the SDI report are: Afghanistan, Argentina, Brazil, China, Egypt, India, Iran, Iraq, Israel, Libya, North Korea, Pakistan, Saudi Arabia, South Africa, South Korea, Syria, Taiwan, Vietnam, and Yemen. Those countries with indigenous missile programs are underlined.

[24] The countries identified are: Argentina, Brazil, Egypt, India, Iran, Iraq, Israel, Japan, Libya, North Korea, Pakistan, Saudi Arabia, South Korea, Syria, and Taiwan. Ibid., p. 10.

[25] See Statement by Steven A. Hildreth on Ballistic Missile Threats and Ballistic Missile Defenses, in U.S. Congress. House. Committee on Government Operations. Subcommittee on Legislation and National Security. Strategic Defense Initiative: What are the Costs, What are the Threats? Hearings, 102nd

proliferation are not hostile to the United States, nor are they likely to pose a threat to the United States. None of those states that are hostile, or may become hostile, have missiles that can reach U.S. territory.

At the same time, the combination of missile proliferation, weapons of mass destruction capability or potential, and likely hostility to the United States or its interests, represent a serious and legitimate threat to U.S. interests in several regional theaters.[26] Short-range missiles (defined here as those with 70 - 1,000 kilometers range) currently could threaten U.S. interests in southern Europe, the Middle East, and East Asia. This is not likely to change over the next decade or so. Medium-range missiles (1,000 - 5,000 kilometers) from China, Israel, Saudi Arabia could potentially threaten U.S. interests throughout Europe, the Middle East, and East Asia. This too is not likely to change over the next decade or so. Although few observers believe there are vital U.S. interests within South Asia, most believe that proliferation in South Asia threatens vital U.S. interests.

**The War Against Iraq**

The 1991 Persian Gulf War also produced several challenges for the United States. A key challenge was to find more effective TMD systems as soon as possible. One might recall that the Patriot system was billed as a star performer in the war. The Patriot's apparent battlefield success against Iraqi-modified Scud missiles reinvigorated the U.S. domestic debate over missile defenses. President Bush proclaimed that Patriot was "proof positive that missile defenses work."[27] Bush focused the SDI program toward providing defenses against missile attacks arising from any source. After the war, Congress passed the Missile Defense Act, giving SDIO a mandate to deploy effective TMD systems as soon as possible, and to move decisively toward deploying a limited defense of the United States.

Since the war, however, the perception of Patriot's success has diminished for two key reasons. First, new Army assessments of Patriot's performance against Iraqi-modified Scud missiles were lowered somewhat.[28] This has had

---

Congress, 1st Session. May 16 and October 1, 1991. Washington, G.P.O., 1992. p. 116.

[26] Ibid., p. 119.

[27] President George Bush. Remarks to Raytheon Missile Systems Plant Employees in Andover, Massachusetts, February 15, 1991. Weekly Compilation of Presidential Documents, Vol. 27, No. 7, Monday, February 18, 1991, p. 178.

[28] Shortly after the war, the Army reported that Patriot destroyed 96 percent of the Iraqi Scuds. See U.S. Congress. House. Committee on Appropriations. Subcommittee on the Department of Defense. Hearings on the FY 1993 Defense Budget. Hearings, , 102nd Congress, 1st Session. April 1991. Washington, G.P.O., 1991. p. 6. This was soon revised to over 90 percent in Saudi Arabia

the effect of removing the shine from Patriot's star performer status during the war. Second, critics of Patriot's performance continue to argue that Army assessments remain highly optimistic.[29] This has fueled lingering doubts over Patriot's performance. Because the issue remains unsettled in the view of some observers, the final chapter of Patriot's performance may therefore not yet be written.

The United States learned several important national security lessons as a result of Iraq's missile attacks, Patriot's role, and the post-war dismantling of Iraq's military capabilities:

- Threats of military retaliation may be insufficient to deter a hostile Third World nation from carrying out theater missile attacks. Facing overwhelming military might, Iraq attacked Israel, Saudi Arabia, and U.S. forces with apparent little regard to military retaliatory consequences;

- Protection against missile attacks cannot rely solely on operations designed to destroy an enemy's missiles and launchers on the ground. Despite extensive intelligence capabilities and numerous optimum opportunities to attack them, coalition forces were largely unable to destroy Iraq's missiles and launchers;

- Patriot's qualified success offers considerable support for the argument that missile defenses can work. Despite the criticism of Patriot, significant political support and expectations for TMD remain; and

- Despite Iraq's formal commitments to nonproliferation and the existence of extensive international and U.S. intelligence networks before the war, Iraq was able to develop a clandestine nuclear weapons program. Its chemical weapons capability was grossly underestimated as well.

Many observers have therefore concluded that TMD programs remain a prudent investment against the likelihood that deterrence and other counterproliferation efforts will not succeed in all cases.

---

and over 60 percent in Israel. After a congressional investigation in early 1992, the Army reassessed Patriot performance. The Army now concluded it had destroyed slightly more than 50 percent of the Scud warheads it engaged. However, it had "high confidence" in having destroyed only 25 percent of the Scuds engaged. See Rep. John Conyers, Jr. The Patriot Myth: Caveat Emptor. Arms Control Today. Vol. 22, No. 9, November 1992. pp. 4-5.

[29] See Statement of Ted A. Postol, Optical Evidence Indicating Patriot High Miss Rates During the Gulf War. Committee on Government Operations, Subcommittee on Legislation and National Security. April 7, 1992. See also, U.S. General Accounting Office. Operation Desert Storm: Data Does Not Exist to Conclusively Say How Well Patriot Performed. September 1992.

### Proliferation and U.S. National Security Policy

Missile proliferation and the spread of weapons of mass destruction promise to make the world increasingly dangerous. There are many potential conflicts in which the United States could become directly engaged and in which regional proliferation is of grave concern. There are other conflicts in which the United States may not get involved militarily, yet may still find its interests threatened by missile attacks.

These challenges are unlikely to diminish. In fact, for the foreseeable future, policymakers will have to face them as long as the United States continues to play an activist role in the post-Cold War world. If this is likely to be the case, most observers would argue that policymakers and defense planners must have TMD systems available to them.

## THE EMERGING NATIONAL SECURITY AGENDA

The challenges posed by proliferation and potential regional conflicts present new opportunities for a comprehensive national security agenda dealing with all proliferation issues. This agenda, waiting to be crafted by President Clinton and the 103d Congress, is likely to build on programs and initiatives that are already underway. These efforts include bipartisan support for TMD and counterproliferation efforts (e.g., export controls, arms control, and enhanced intelligence gathering). This agenda may create its own problems, however, as tensions inevitably arise over national security requirements and domestic economic needs.

### Theater Missile Defenses

There little political opposition to developing and deploying effective TMD systems in a world where missiles and weapons of mass destruction proliferate. TMD systems are seen as providing numerous benefits to the United States. They could help defend U.S. forward-deployed bases and forces overseas, preserve security commitments with friends and allies, and reserve the policy option to intervene in regional crises and conflicts. Although a few observers may raise some questions over arms control, cost considerations, and political implications *vis-a-vis* Russia and NATO Europe, these are not likely to reverse the U.S. commitment to TMD.[30]

---

[30] For a more detailed analysis of potential costs and benefits, see U.S. Library of Congress. Congressional Research Service. Ballistic Missile Defense Deployment Options, by Steven A. Hildreth and Amy Woolf. CRS Report No. 91-560F, July 19, 1991. For a useful overview of TMD roles and missions, see U.S. Library of Congress. Congressional Research Service. Roles and Functions of U.S. Combat Forces: Past, Present, and Prospects, by John Collins. CRS Report No. 93-72S. January 21, 1993. pp. 21-25.

Still, questions remain over what is sufficient and which types of TMD systems should be supported. The review of current programs later in this report suggests there may be some redundancy of effort as parallel development of comparable TMD programs proceed. If true, potential budget savings are available to decisionmakers. Whether some TMD programs will be cut in an overall atmosphere of reduced federal spending will depend on reconciling national security needs with domestic economic considerations. This report further raises questions as to whether the TMD effort is sufficiently comprehensive, balanced, and developed.

**Counterproliferation**

Because it may be many years before many theater missile threats emerge, the United States has an opportunity to explore parallel efforts to counter those threats or slow their development. These may include military, political, economic, and arms control measures.[31]

In 1992, in an important development, the Pentagon attempted to consolidate its nonproliferation efforts into a new organization. This would be headed by a new Deputy Undersecretary of Defense for Counterproliferation Policy (CP) under the Office of the Undersecretary of Defense for Policy. The organization would be guided by a new CP strategy (undeveloped and put on hold at the end of the Bush Administration) to be built on a new regional defense strategy.[32]

The proposed CP organization would have several goals. First, it would further the new regional strategy through the DOD CP strategy. Second, it would seek to give DOD a strong CP analysis, CP policymaking, and CP activity-

---

[31] These include, for example, supplier controls, negotiated controls on missile technology, alternative security arrangements or agreements, and strengthening of existing control regimes such as the International Atomic Energy Agency (IAEA) and the Missile Technology Control Regime (MTCR). A more detailed analysis of these ideas can be found in various CRS reports. See for example, U.S. Library of Congress. Congressional Research Service. Missile Proliferation: A Discussion of U.S. Objectives and Policy Options, by Robert Shuey. CRS Report No. 90-120F.

[32] Among other things, the U.S. National Security Strategy (August 1991) seeks to prevent the transfer of militarily critical technologies and resources to hostile nations or groups, and stop global proliferation. The nonproliferation strategy seeks to strengthen existing arrangements, expand the membership of multilateral regimes, and pursue new initiatives. In furtherance of U.S. interests, the new Regional Strategy would shape the global security environment to gain and retain maximum strategic depth. Counterproliferation efforts would seek to: 1) deter attack from whatever source against the U.S., its forces, and friend and allies; 2) strengthen and extend the system of collective security arrangements against aggression; and 3) help preclude regional conflict by reducing sources of instability and to limit violence should it occur.

organizing capability (e.g., export control reviews, strategic planning and analysis, and inspection and technical support). Third, it would develop a corps of CP staff within DOD.

Defense Secretary Aspin proposed a new DOD reorganization, which would consolidate all the nuclear and nonproliferation efforts under a new Assistant Secretary of Defense. The organizational and personnel details are not yet available. This new effort will apparently build on some of the objectives identified in the earlier proposed CP organization.

President Clinton has made it clear that nonproliferation will be an important national security priority. There are indications that the Administration will consolidate its efforts into a single position, probably within the existing National Security Council structure.[33] There may be several reasons for this. First, nonproliferation policy is fragmented across the Government. There is no presidentially approved organization that has the authority to cut across existing lines to coordinate the work of all agencies involved, resolve disputes, and ensure that all act as a single team. There are also indications that a broad, presidentially endorsed policy on proliferation may be forthcoming, but the details are currently unavailable.

In any case, tensions are inevitable. National security requirements suggest greater restrictions on controlling technology and exports. At the same time, economic factors suggest the need for perhaps relaxed controls on exporting U.S. advanced technology. The creation of a new Economic Council in the Clinton White House promises considerable competition with the existing National Security Council over counterproliferation issues.

## CURRENT ORGANIZATIONAL AND OPERATIONAL CONCEPT FOR THEATER MISSILE DEFENSE

The military rationale for theater missile defenses can provide insights into the current status and organization of TMD programs. This section discusses the formal military requirements established for TMD. In addition, this section examines the way in which the Department of Defense and the military services currently are organized to develop, deploy, and use TMD systems.

### MILITARY REQUIREMENTS FOR TMD

As a formal part of the Defense Department's current acquisition process, every major weapon system must be justified by what is called a Mission Needs Statement (MNS), approved by the JCS. In November 1991, the JCS approved such a statement for TMD. As defined by the Pentagon, the purpose of the MNS for TMD is "to guide service and joint doctrine, training, force design, and materiel developments, including other MNS's, to counter the theater missile

---

[33] Interviews with Clinton-Gore campaign and transition workers.

threat. It should also guide cooperative efforts with U.S. allies." Accordingly, "the mission of TMD is to protect U.S. forces, U.S. allies, and other important countries, including areas of vital interest to the United States from theater missile attack." This task would be accomplished by pursuing the following JCS objectives for TMD:

- To prevent the launch of theater missiles against U.S. forces, allies, and other important countries and areas of interest;
- To protect U.S. forces, allies, and important countries and areas of interest;
- To reduce the probability of and to minimize the effects of damage caused by a theater missile attack; and
- To detect and target theater missile platforms, to detect, warn and report of theater missile launch, and to coordinate a multifaceted response to a theater missile attack and to integrate it with other combat operations.

**TMD Mission Areas**

According to the Defense Department, these objectives require certain capabilities. The JCS groups these capabilities into four TMD mission areas called active defense, passive defense, attack operations (counterforce), and command, control, and communications, and intelligence ($C^3I$).[34] The TMD mission areas are important to understand better the complexity and scope of the entire TMD effort, assess its current status, determine where additional support may be needed, or where excessive redundancy may exist. These four mission areas (sometimes called functions) are described below.

***Active Defense***

To protect against a theater missile once it has been launched, the JCS have determined they require the military capacity to destroy that missile at every point of its flight trajectory, from immediately after launch to shortly before impact. According to the JCS, therefore, active defenses must provide multiple opportunities to destroy an attacking missile throughout its flight. Such defenses could consist of space-, air-, ground-, and sea-based systems. The Patriot system is an illustrative example of a system that seeks to destroy attacking missiles before they can reach their target.

---

[34] Missions are specific tasks assigned by the President or the Secretary of Defense to the various combatant CINCs. The specific responsibilities of the combatant CINCs are spelled out in the Unified Command Plan prepared by the Joint Staff, then reviewed by the JCS and the Secretary of Defense, and finally approved by the President.

### *Passive Defense*

Capabilities for passive defense are required by the military to reduce the probability of and to minimize the effects of damage caused by a missile attack. Passive defenses could make it more difficult for an attacker to locate and target those assets that required defense, could lessen key system vulnerabilities, and increase long-term survivability. Passive defenses might include counter-surveillance, deception, camouflage and concealment, hardening, electronic warfare, mobility, dispersal, and redundancy.

### *Counterforce Operations*

The JCS also requires the capability to prevent theater missiles from launching against their intended targets in the first place. This might be accomplished by attacking elements of the overall theater missile system. For example, during the Persian Gulf War, allied forces repeatedly sought to destroy mobile Iraqi missile launchers with fighter aircraft. Counterforce operations could include such actions as destroying launch platforms, support facilities, reconnaissance, intelligence, surveillance and target acquisition platforms, command and control facilities, and missile storage depots. These operations might be performed by all offensive forces, including space, air, ground, maritime, and special operations forces.

### *Command, Control, Communications, and Intelligence ($C^3I$)*

Finally, the JCS requires an overall system, or architecture, to coordinate its active and passive defense efforts and counterforce operations. The TMD system would also have to be integrated into overall theater combat operations. $C^3I$ must include, for example, wide area surveillance, timely warning and threat assessment, accurate target discrimination, cuing and cross-cuing of various sensors, tasking to appropriate U.S. and allied attack forces, and the ability to conduct accurate damage assessment.

## Relationship of TMD to GPALS

TMD fit into a broader defense concept adopted during the Bush Administration. In 1991, the Bush Administration refocused the SDI program to develop and deploy a comprehensive missile defense system against limited attacks. This new effort was called GPALS (Global Protection Against Limited Strikes). Although there was never any specific JCS MNS established for GPALS, the Administration proceeded on the grounds that GPALS was justified under a previous, more comprehensive deployment concept adopted by President Reagan.[35]

---

[35] The Bush Administration maintained that a MNS for GPALS was not necessary. Instead, it believed the JCS MNS for the Phase 1 Strategic Defense System (an earlier, far more expansive SDI architecture for addressing a massive Soviet nuclear attack) was sufficient to justify GPALS as a step toward the Phase 1 system. The JCS apparently concurs.

GPALS envisioned three components: (1) TMD systems are planned for concurrent development and deployment with a (2) National Missile Defense (NMD) of the United States. These two components would be deployed before (3) a Global Protection System (GPS). At the time, Bush Administration plans called for the deployment of near-term TMD systems during the mid-to-late 1990s and advanced TMD capabilities in the latter 1990s. After the year 2000, these and other more advanced TMD systems were to be augmented with space-based sensors (called Brilliant Eyes) and integrated with space-based interceptors (called Brilliant Pebbles) to form a broader, global TMD capability as part of the GPALS system. The military service's plans for TMD were based ostensibly on the proposed GPALS concept.

In addition to the technical and systems relationship of TMD and GPALS, there was a strong political relationship. The Administration believed that support for GPALS rested on the popular support for TMD and a NMD system for the United States. Instead of thinking of TMD as part of a more integrative global defense system, Congress viewed TMD systems as independent and distinct. The Clinton Administration view is likely to be similar to that of Congress. Furthermore, the Clinton Administration is not expected to support the GPALS concept.

## DEFENSE DEPARTMENT ORGANIZATION

The organizational structure for TMD within the Department of Defense has changed several times and may be modified further as programs mature, assignments are reviewed, and interservice rivalries are settled.[36] The Clinton Administration and the Congress may also seek to revise or affect the various service roles and missions and reorient priorities. The current structure of the TMD effort as organized is described below.

### Role of the BMD Organization

In February 1991, Defense Secretary Cheney testified before the Senate Armed Services Committee that "SDIO has been charged with developing advanced defensive technologies to deploy much improved, transportable theater missile defenses within the next five years." According to the Defense Department, BMDO will provide day-to-day TMD program management and direction for all of the Defense Department. It will do this by integrating the needs of the warfighting commanders-in-chief and military services, as well as the technical approaches to resolve those needs. BMDO has been given the responsibility to integrate the four JCS mission areas or functions that were described above. Moreover, in coordination with each of the military service and

---

[36] The triennial JCS review of service roles and missions, by Chairman Colin Powell, widely considered to be critical to the post-Cold War reorganization of the U.S. military, did not modify the service TMD functions.

DOD acquisition heads, BMDO has been given extensive program-management responsibilities.[37]

## Role of the Military Services

### *Service Roles and Missions*

In a 1991 report to Congress, SDIO broadly outlined the service roles and missions.[38] The services are to:

- Participate in the establishment of operational requirements for the protection of assets;
- Manage TMD programs under BMDO direction;
- Participate in the conduct of Developmental Test and Evaluation;
- Conduct Operational Test and Evaluation;
- Support production, deployment, and operation of assigned TMD material as agreed upon;
- Plan for and fund TMD programs after transition to the services, including operation and support and TMD force structures; and
- Coordinate their efforts with the other services.

---

[37] These include: leading proposed TMD system studies; defining overall system functions and operations; managing overall system engineering; assuring the integration of appropriate SDI technology into TMD programs; identifying research and development activities, funding, and guidance to the services; coordinating, developing, and funding $C^3I$ integration; evaluating TMD plans for fulfillment of operational requirements, system operations, and functions; assessing the program's incorporation of the four TMD mission areas; setting minimum performance standards for systems; providing access to SDIO facilities for simulation testing; quantifying and managing TMD developmental test and evaluation; executing technical programs and activities with allied and friendly nations; and requesting adequate funding to develop and test demonstration systems in a timely manner.

[38] U.S. Department of Defense. Strategic Defense Initiative Organization. Theater Missile Defense Report to Congress. Washington, DC. March 30, 1991. See also, U.S. Department of Defense. Strategic Defense Initiative Organization. Report to Congress: Plan for Deployment of Theater and National Ballistic Missile Defenses [also referred to as the 180-day report]. Washington, D.C. June 1991. pp. 18-19.

### *Army*

In broad terms, the Army believes TMD capabilities are required to defend its troops and other ground-based military assets and expeditionary forces from theater missile attacks. The Army also believes it may be called upon to defend population centers, as was the case during the 1991 war against Iraq.

The Army has been given primary responsibility to develop ground-based and Army space-based and airborne TMD systems. To do this, the Army is pursuing a two-tiered concept for active defense. The lowest tier would defend against aircraft and cruise missiles. In this regard, the Army is tasked to continue TMD-related improvements to the Patriot system and the Hawk replacement (i.e., CORPS SAM), and develop ERINT. (These and other TMD programs are described later in this section.) An upper tier of defenses would include THAAD and a new, advanced radar system designed to destroy attacking missiles at higher altitudes and longer ranges. Hopefully, this would occur far from the defended asset so that debris would not damage it. The Army is looking at a variety of passive defense and counterforce capabilities as part of its overall contribution to TMD as well.

### *Navy*

The Navy anticipates that TMD will become an important new mission for the service. Naval advocates believe naval forces can play a critical and unique TMD role. Congress has expressed interest in this potential. Naval TMD systems could offer protection from the sea before, during, and after deployment of theater ground-based forces into a regional conflict.[39] In many scenarios and geographic locations, naval TMD systems may be the first or only TMD force deployed to support planned theater operations. The Navy argues that about 60 percent of the world's major population centers could be protected from the sea if both Navy programs (upper-tier and lower-tier defenses) were deployed.

To this end, the Navy is given primary responsibility to develop any sea-based TMD components. It has several tasks: investigate enhancements to the existing Aegis air-defense missile system as a near- and long-term active defense option; develop operational requirements for improving force projection capabilities and the coastal defense of naval assets in contingency theaters; and, evaluate the impact of TMD and its interaction with air defense of naval assets. BMDO is projected to spend about 25 percent of the TMD budget over the next six years on development of naval TMD programs.

### *Air Force*

The Air Force sees itself as having an important TMD role with respect to counterforce operations. The Air Force has a variety of airborne platforms (e.g., Joint Stars and AWACS surveillance planes, and F-15 fighter aircraft)

---

[39] See: Sea-Based Theater Missile Defense (white paper). Strategic Defense Initiative Organization. December 10, 1992.

potentially capable of identifying enemy missile assets, and targeting and destroying them before they can launch their missiles. The Air Force also sees itself playing a role in active defense as well. Using airborne platforms, the Air Force believes it may be possible to destroy attacking missiles shortly after their launch over enemy territory. If possible, this would be considered greatly beneficial for the conduct of theater operations.

To this end, the Air Force has been given primary responsibility to develop space-based, airborne, and some ground-based TMD system support components. The Air Force has other responsibilities too. It is to: establish operational requirements to protect its own assets; evaluate the interaction of TMD and conventional air defense operations; evaluate various sensors and weapon systems to support TMD counterforce operations; and provide air- and space-based sensor support to deployed forces. The Air Force portion of the TMD budget is relatively small.

### *Marine Corps*

The Marines view their greatest threat from theater missiles with relatively short ranges--up to that of the Scud system (about 300 kilometers). They are therefore seeking to provide a limited area, highly mobile self-defense capability against those missiles. Such defenses would be required for amphibious landings and after deployment to a theater of operations where missile threats are likely.

The Marines are tasked by the Secretary of Defense to identify and define requirements for TMD self-defense for forward deployed and expeditionary forces. They are also to assist in the analysis of TMD for coastal force projection and defense of naval assets in contingency theaters, and to assist in evaluating the impact of TMD and its interaction with air defense of naval assets.

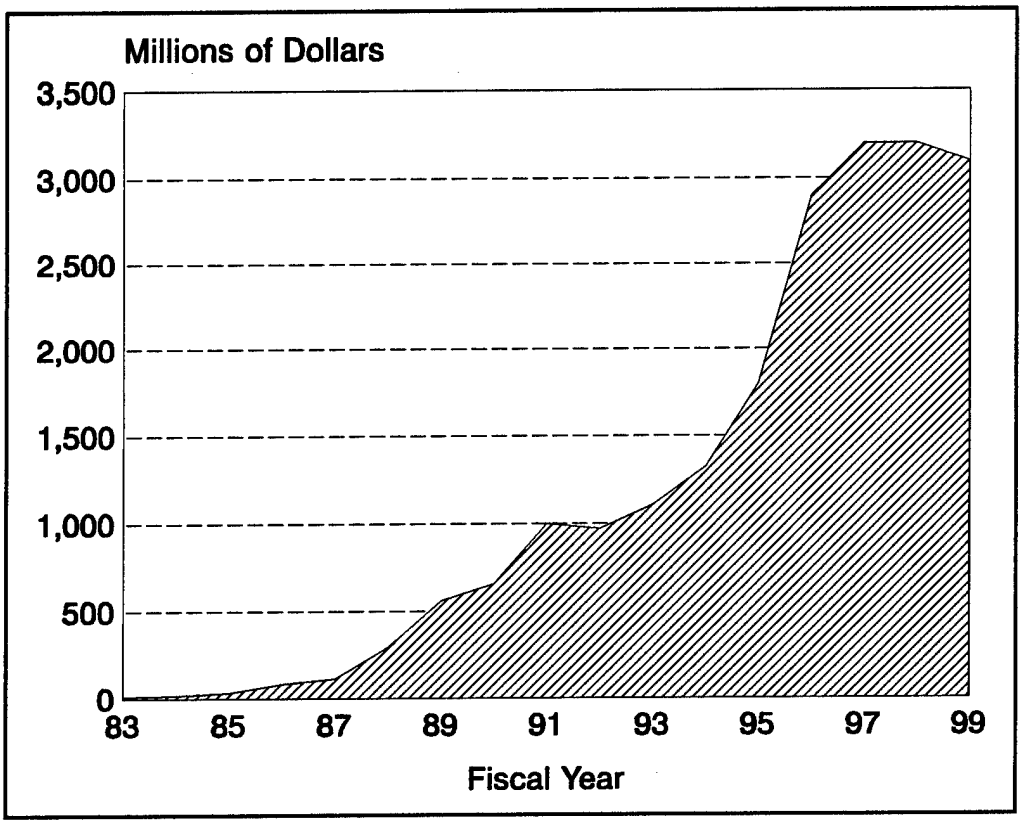
## Role of Others

Several other defense agencies and commands are tasked with TMD-related responsibilities. They include: the Defense Intelligence Agency, which identifies and characterizes projected threats for TMD development programs; the Defense Communications Agency projects TMD telecommunications requirements and integration issues; the Theater/Specified Commanders-in-Chief (CINCs) identify TMD requirements for their theater of responsibility; and the Chairman, JCS, who, in conjunction with the CINCs, will coordinate and validate mission needs and operational requirements, establish command and operational control doctrines, and establish command relationships, force structures, and rules of engagement.

## CURRENT STATUS OF TMD PROGRAMS

Since fiscal year 1983 (the first year for Patriot antitactical missile funding), the Army and SDIO have spent almost $2 billion on TMD programs. Chart 1 illustrates the annual amount of TMD spending through FY 1992. The chart also projects budget requests through FY 1999.[40] With that money to date, one air-defense system (Patriot PAC-2) was upgraded, giving it a limited, self-defense capability. Most of the money, however, was spent on pursuing a number of other TMD research and development programs. Some of these remain under consideration. Some funding was also allocated for studying the requirements for TMD systems and defining TMD architectures.

**Chart 1**
**Tactical & Theater Missile Defense Spending**
**Fiscal Years 1983 - 1999**




In 1992, the TMD program was expanded significantly to emphasize the transition from research and development to production of TMD systems in the near- and far-term. This accounts for much of the increase in TMD budgets.

---

[40] See: Ambassador Henry F. Cooper. A Summary of SDI Programs and Plans for Theater and National Ballistic Missile Defenses. Strategic Defense Initiative Organization. Jan. 4, 1993. p. 2.

Several key program decisions were made in 1992; others planned for 1993 could lead to upgrades to existing capabilities and establishment of new systems and capabilities. These program decisions account for the dramatic increases projected for TMD funding.

This section examines the breadth of U.S. TMD programs. It does so in the context of the four JCS mission areas described earlier. This demonstrates how BMDO and the services are following the JCS TMD mandate. This approach suggests there are areas that might be reviewed this year. In this regard, Congress could play a key role.

## ACTIVE DEFENSE PROGRAMS

Active defense TMD programs receive the greatest funding support. This section examines a number of TMD programs aimed at improving near- and far-term active defenses (primarily interceptor programs) against theater missiles. The section reports on efforts designed to destroy theater missiles throughout their flight trajectory.

### Near and Mid-Term Initiatives

The 1991 Persian Gulf war generated broad political and military consensus and intensified interest in acquiring TMD capabilities as quickly as feasible. It was felt that such capabilities were needed to deal with a potential crisis that might arise during the mid-1990s. This consensus fueled an expansion of near- and mid-term (defined here as FY 1993 - FY 1999) active defense TMD initiatives.

#### *Patriot PAC-3 Interceptor Upgrade*

During the Gulf War, the U.S. and Israeli forces used the Patriot Anti-Tactical Ballistic Missile Capability - 2 (PAC-2) system to defend key military assets and populated areas. Since the war, a number of modifications have been made to the PAC-2 system. A more ambitious upgrade is planned called the Patriot Advanced Capability - 3 (PAC-3).

Program Description

PAC-3 is a total system performance improvement capability designed to counter the evolving and more stressing tactical ballistic missile (TBM) and air-breathing threats. PAC-3 represents the next evolutionary step in the development of Patriot and responds to the Army-approved Operational Requirements Document.

The Patriot Growth program consists of phased and incremental improvements to achieve this capability. The Growth Program includes hardware and software improvements to the radar, launcher, generator,

computer, communications, command and control, target identification, and remote launch. Also included are emplacement enhancements and a new missile. The synergy of these improvements will hopefully provide an enhanced area defense against the TBM and air-breathing threats.

Projected Capability

The PAC-3 program is designed to increase the Patriot's capability against short-range missile attacks by extending its defensive radius from a dozen or two kilometers to several dozens of kilometers. This would be accomplished through the planned radar enhancements and a new missile. The PAC-3 missile will seek to improve Patriot's capability to counter advanced high-speed TBM threats, and increase Patriot's battlespace by maximizing Patriot's design capability against a wide range of targets. The goal is to make the PAC-3 missile more accurate to permit engagement of TBMs at higher altitude, thereby increasing the defended battlespace.[41]

Program Status and Projected Milestones

There are two candidates for the PAC-3 missile: the Multimode Missile and the Extended Range Interceptor (ERINT). Both missiles have active (on-board radar) guidance. The two candidate missiles reflect different technologies. The Multimode Missile is an improved version of the Patriot PAC-3 missile. The Multimode Missile includes semi-active track-via-missile guidance, improved propulsion and uses an aimed blast fragmentation warhead. The ERINT missile employs nit-to-kill technology and is based on the Flexible Lighweight Agile Guided Experiment (FLAGE). Both the Multimode Seeker and the ERINT missiles are undergoing flight tests. A decision is planned the mid-FY 1994. The number of missiles and launchers produced will be a function of the missile selected.

Program Cost

According to the Pentagon, the total Patriot TMD PAC-3 Upgrade Program will cost about $2.7 billion.

***Navy Standard Missile Upgrade***

Program Description

The Navy is seeking to improve the capability of its existing air-defense missile, the Standard Missile 2 (SM-2) Block IV A, in much the same way as Patriot acquired an ATM capability. The upgraded Standard missile would be deployed in the existing Vertical Launch System (VLS) on board Aegis ships.

---

[41] See SDIO Director Amb. Henry Cooper's testimony in U.S. Congress. House. Committee on Appropriations. Subcommittee on Defense. Strategic Defense Initiative. Hearings, 102nd Congress, 2nd Session. April 7, 1992. Washington, G.P.O., 1992. p. 23-24.

The SM-2 missile will be upgraded with a new warhead, improved sensor, and modified fusing mechanisms. Raytheon is the prime contractor. (Other system upgrades will include software modifications to the Aegis radar and display system, additional data storage capacity, and an improved command and control decision system. No changes will be required to the VLS.)

Projected Capability

The Navy believes that the SM-2 upgrade and other system improvements, will give it a capability comparable to the Army's Patriot PAC-3 system in terms of defended area. This near-term option, the Navy argues, would give it a capability to defend debarkation ports, coastal airfields, and defend amphibious landing areas for expeditionary forces as they come ashore.

Program Status and Projected Milestones

The SM-2 upgrade is scheduled for a deployable prototype, or UOES,[42] no later than 1997. Full operational capability would be achieved by 1998-99.

***Hawk Missile Upgrade***

Program Description

The Hawk is an older, mobile air-defense system. The Marines plan what they consider to be modest upgrades to the Hawk missile launching system and associated radar (the TPS-59, described later). The Hawk upgrade program seeks to upgrade the system software so that it can determine if a missile threat can be engaged. It will also seek to predict the missile's impact point. Further upgrades will be made to the system's communication equipment. The current program will provide for three and a half modified-Hawk battalions.

Projected Capability

According to the Marines, this program will give them a near-term point-defense capability to complement longer range sea-based TMD systems until Patriot or THAAD batteries are in place ashore.

---

[42] According to the SDIO, the UOES (User Operational Evaluation System) "can best be thought of as exploiting operational assessment prototypes, providing, in case of an urgent operational need, a 'system' capability during the demonstration and validation stage of development." See, Amb. Henry F. Cooper. A Summary of SDI Programs and Plans for Theater and National Ballistic Missile Defenses. Strategic Defense Initiative Organization. Jan. 4, 1993. p. 2.

Program Status and Projected Milestones

A production decision is scheduled for FY 1994. Actual field equipment is expected by FY 1995. Production is expected to continue through the end of the decade.

Program Cost

It is anticipated that the Hawk upgrade program will cost less than $100 million.

### *THAAD UOES Program*

Program Description

To improve its missile defenses beyond that of the Patriot PAC-3, the Army wants to deploy a wide-area, high-altitude capability. This program is called THAAD (Theater High Altitude Area Defense). The fully operational THAAD system is described in more detail later. In response to the Missile Defense Act, a prototype THAAD battery (or UOES) is planned to allow for early operational assessments and could be deployed during a crisis for use by U.S. military forces possibly in 1996, rather than in 2002. The UOES will consist of portions of 2 batteries (a total of 3 THAAD launchers, forty missiles, 2 new prototype radars, and associated battle management, and command and control systems).

Projected Capability

The capability of the proposed THAAD UOES is unknown; it's expected capability will be determined during the demonstration/validation phase, which ends in late FY 1996. But the prototype system is expected to give the Army a limited area-defense capability against theater missiles for contingencies that might arise before the fully operational system can be deployed. The projected capability of the fully operational THAAD system is described later.

Program Status and Projected Milestones

The demonstration and validation (dem/val) contract was awarded to Lockheed in September 1992. The decision to produce the UOES missiles is planned for FY 1995 by the Pentagon; Congress will be asked to provide funding for the program in 1993 and 1994. The THAAD UOES is planned to be available at the conclusion of the demonstration/validation phase (end of FY 1996).

## Long-Term Initiatives

There are a number of advanced, active defense programs that could lead to deployment around the year 2000 and beyond. They are described below.

### *Limited-Area and Point-Defense Programs*

There are a couple of advanced TMD programs underway that could lead to effective defenses of limited areas and specific military assets, such as airfields or command centers.

*ERINT.* The ERINT (Extended Range Interceptor) program seeks to demonstrate the technical feasibility of integrating faster, hit-to-kill missiles (in contrast to Patriot explosive warheads) with the Patriot launcher. If successful, 16 ERINT missiles could be deployed on a launcher where only 4 Patriot missiles are now deployed. The ERINT program will also examine the missile's potential for destroying chemical warheads. In terms of range, some suggest that the ERINT may wind up being comparable to the capability of the Patriot PAC-3 system. ERINT supporters would dispute this, however, arguing that greater interception ranges will be achieved.

Flight tests of the ERINT missile began in FY 1992 and will continue at least through the PAC-3 Missile decision in FY 1994. Production of the missiles could begin in FY 1996-97. The systems could be fielded by the late 1990s with Patriot batteries, pending a 1994 DOD decision to do so.

*CORPS SAM.* CORPS SAM (Corps-level Surface-to-Air Missile) would be the successor to the Marines Hawk point-defense system. It would seek to extend the range and effectiveness of mobile TMD capabilities for the Marine Corps, contingency operations, and rapid reinforcing missions. As planned, CORPS SAM would provide point and area defense capabilities against TBMs and air-breathing threats. The system is planned to be compatible with other Army air-defense and TMD systems, as well as joint/allied sensors and battle management and command and control networks.

Currently in a concept development stage, CORPS SAM will be reviewed by the Pentagon for demonstration and validation in mid-to-late 1993. CORPS SAM would not be fielded until about 2005. The CORPS SAM program has come under close scrutiny in 1993. Its future is now especially uncertain.

### *Wide-Area Defense Programs*

There are several advanced active defense programs underway that are planned to provide effective defenses of larger areas or regions. Such defenses would seek to protect the range of military assets, troops, and population centers with that region or theater.

*Brilliant Pebbles.* Brilliant Pebbles are space-based interceptors. As envisioned, Brilliant Pebbles interceptors would be deployed on hundreds of low-orbit satellites in space, awaiting warning of an attack and then launching toward their targets while still in space. Brilliant Pebbles were originally seen by BMD advocates as key to a comprehensive global missile defense system.

More recently, BMD supporters have noted the advantages of deploying them for TMD missions. BMDO maintains that space-based interceptors can provide global missile defense capabilities at all times, particularly before the outbreak of a crisis when other TMD systems may not yet be in place.[43] SDI Director Cooper has asserted that Brilliant Pebbles interceptors could have attacked Iraqi Scuds launched in 1991; he maintains that missiles with ranges greater than about 300 kilometers could be attacked with Brilliant Pebbles. Some scientists were skeptical the proposed system could perform as described. If the BMD plan is pursued, Brilliant Pebbles interceptors could be available sometime after 2000 or so.

*Army THAAD.* As mentioned earlier, the planned Army THAAD program is to be the mainstay of the military's development of an effective land-based area TMD system.

Program Description

The THAAD program is designed to fill Army requirements for a transportable (by a C-141 cargo plane), wide-area TMD system. The program seeks to demonstrate the technical feasibility of area defenses and provide for high-altitude engagements. THAAD will be integrated with existing and future air-defense systems. When deployed, THAAD would acquire its target with the new Missile Defense Ground Based Radar-Theater (TMD-GBR, which is described later) system, launch its missiles, receive in-flight updates, and use terminal homing to intercept and destroy the target by a direct hit.

Projected Capability

The THAAD system will seek to provide theater military commanders with multiple opportunities to intercept missiles at extended ranges and at high- and medium-altitudes to minimize potential collateral damage. It is projected that THAAD could intercept theater missiles at ranges up to 100 kilometers with a high probability of kill. It has been argued that THAAD could intercept theater missiles at ranges of several hundreds of kilometers range, depending on the speed of the incoming missile, cueing from other sensors, and other factors. THAAD could be used to defend large areas that required protection from missile attacks.

Program Status and Projected Milestones

As mentioned earlier, the THAAD dem/val contract was awarded in late 1992. A THAAD UOES will be available in 1996. Fully operational THAAD batteries would be available by 2002.

---

[43] See: Report to Congress: Conceptual and Burden Sharing Issues Related to Space-Based Ballistic Missile Interceptors. Strategic Defense Initiative Organization. March 1992.

Program Cost

The total program cost for THAAD and the TMD-GBR is estimated at $7.5 billion.

*Navy-modified THAAD.* The Pentagon is exploring the possibility of adapting the Army's proposed THAAD interceptor for naval use to see if THAAD would be compatible with the Navy's Vertical Launch System.

In mid-1992, under the auspices of the THAAD contract, Lockheed examined the feasibility of using the Army's proposed THAAD system for the Navy. More specifically, the study addressed design impacts and cost and schedule implications of modifying the THAAD for the Aegis VLS. The study concluded that it is possible to adapt THAAD missiles for naval use, but that it might not be cost effective.

Safety concerns are a critical consideration for the Navy. The THAAD missile interceptor would use a liquid control thruster fuel, which the Navy has long opposed for shipboard use. Gel and solid fuel alternatives apparently are being considered. The Navy is expected to make a decision in 1994 on THAAD and other long-term TMD alternatives. Information from the Lockheed study will be one of many inputs to this decision process.

If the Navy chooses THAAD, its program would be separate from, but largely parallel to the Army effort, although production and deployment schedules might differ. The Navy will not make a decision on THAAD, LEAP, or some other new missile until FY 1994.

*Navy Standard/LEAP.* In addition to the THAAD alternatives, the Navy is examining the feasibility of another option called the Navy LEAP. Up to 50 Aegis-class cruisers and destroyers could be made available for this mission.

Program Description

The Navy wants to develop and deploy a long-range exoatmospheric TMD interceptor as soon as possible. Currently, naval plans call for accelerated tests of naval Standard Missiles and LEAP (Lightweight Exoatmospheric Projectiles) interceptors. The objective is to integrate the two, which would extend the missiles' range considerably, according to advocates.

Projected Range Capability

SDIO Director Cooper recently stated that he believed this interceptor could reach out to defend areas in excess of 1,000 kilometers.[44] Privately, naval officials have also used the figure in their discussions of this program.

---

[44] THAAD Use on Navy Ships Will Take 18 Months to Decide. Inside the Navy. Jan. 11, 1993. p. 11.

Program Status and Projected Milestones

According to SDIO Director Cooper, this approach was recently validated. In September 1992, an Aegis destroyer launched into space a Terrier air-defense round with a payload built to the dimensions and weight of a LEAP.[45] Four more tests are planned for 1993 and 1994; the Navy will also start to use the SM-2 missile in its tests. Production could begin in the mid-1990s, and BMDO maintains that a contingency capability could be available in 1998.

Program Cost

Integration of the Standard missile and the LEAP, along with upgraded battle management and command and control, is expected to cost about $4.5 billion.

*U.S.-Israeli Arrow (ACES) Program.* ACES is a joint U.S.-Israeli initiative designed to determine whether the Israeli Arrow missile could intercept theater missiles at extended ranges and high altitude. If it can, it might provide Israel with the capability to defend Israeli military and civilian targets against conventional and perhaps chemical warhead missiles. The Arrow interceptor would seek to destroy its targets with a fragmentation warhead (such as with Patriot).

In March 1992, the two countries signed a $322 million contract to develop Arrow. The United States will pay for 72 percent of this contract, while Israel is to pay the remainder.[46] The previous effort to develop Arrow (1988-1991) largely was viewed as disappointing. The Arrow program did not achieve its goal of intercepting a theater missile. In 1993, the first ACES tests will begin. Eleven tests are scheduled. At the end of the current contract phase, a decision whether to proceed with production will be made, presumably by the Israelis and perhaps the United States. Total program costs have varied significantly, ranging from $2 to $10 billion. At this point, it is not certain whether Arrow will be produced and deployed, and it is unclear who will pay for those costs.

***Boost-Phase Intercept***

A variety of concept studies are underway or planned to examine the feasibility of boost-phase (the period from launch until about the time the missile leaves the atmosphere) intercept of theater missiles. In October 1992, the Air Force launched a nine-month Boost Phase Intercept Concept Exploration Study. The basis for these efforts lies in the JCS MNS, which provides justification for programs designed to destroy attacking missiles at all points along their flight trajectory.

---

[45] Cooper. A Summary of SDI Plans and Programs. p. 5.

[46] Israel can pay for this from any source, including the annual U.S. Foreign Military Finance (FMF) contribution to Israel (about $475 million).

Boost-phase interception of missiles is considered important for two reasons. First, the intercept would likely occur over enemy territory, and any falling debris would likely fall there. Second, early interception would occur prior to the missile's release of sub-munitions, such as chemical or biological weapons.[47]

*Tactical Fighter Aircraft.* The Air Force is examining the feasibility of using existing or modified aircraft-launched missiles to destroy theater missiles in their boost-phase. The AMRAAM (Advanced Medium-Range Air-to-Air Missile), once under consideration for this role, has reportedly been discarded in favor of another unspecified type of boosted air-to-air weapon. This effort faces tremendous technical obstacles, however. As one Air Force official involved said, "an actual intercept would require three miracles in a row."[48]

*Airborne Laser Concept.* The Air Force and others are reportedly interested in evaluating the use of airborne lasers for TMD. This nascent TMD program is still too early to evaluate. The purpose of this effort would be to determine the feasibility and utility of airborne high-energy lasers for boost-phase interception within a theater of operations. Some reports suggest that a laser demonstration could begin in 1996 and a prototype built and tested in 1998. Last year, Lawrence Livermore Laboratory was reportedly interested in Russian laser technology for possible basing in a long-range B-52 bomber or an unmanned aerial vehicle (UAV).[49] Livermore scientists believed that such a system could shoot down Scud missiles at ranges of 150 kilometers.

*Unmanned Aerial Vehicles.* The BMD Organization is pursuing a concept program called RAPTOR/TALON, which would use UAV's to carry TMD interceptors against missile targets during their boost-phase. As designed, these UAV platforms would be deployed high in the atmosphere and close to potential missile launch sites (likely near or over enemy territory) to permit interception before missile booster burnout.[50]

---

[47] Report to Congress: Plan for Deployment of Theater and National Ballistic Missile Defenses [180-day report]. p. 18.

[48] First, it would require that the aircraft be close to the missile launcher when the missile was launched. Second, it would require that the aircraft be able to maneuver in time to acquire and target the rising missile target. Third, it would require the air-to-air interceptor to be able to target, track, and destroy the rising missile. Briefing, June 1992.

[49] See Aviation Week and Space Technology. July 20, 1992, pp. 64-65.

[50] See Report to Congress: Plan for Deployment of Theater and National Ballistic Missile Defenses [180-day report]. p. 18.

In addition, the BMD Organization reportedly will soon negotiate with Israel's Defense Ministry to examine concepts for boost-phase TMD.[51] These technical studies will look at the possibility of using UAV's operating over hostile territory as platforms for intercepting theater missiles over enemy territory. Nothing further is available on this study at this time. Nevertheless, BMDO is conducting its own independent study. Preliminary results should be available in the summer of 1993.

## PASSIVE DEFENSE INITIATIVES

Each of the services apparently is looking at a large variety of passive defense measures as part of their overall TMD effort. Beginning in 1993, the Air Force plans to conduct several such studies. The Army is looking to adapt an assortment of radar and sensor assets to assist in fulfilling the passive defense TMD mission.[52]

Another Army initiative is the Patriot Remote Launch program. This will permit Patriot missile launchers to be moved far from the system's radar. The purpose is to try to provide greater survivability of the Patriot system by dispersing its component parts. According to its supports, this will also increase the Patriot's battlespace coverage. As planned, the Patriot Remote Launch program is being pursued in three different deployment phases, each with increasing capability, through the remainder of this decade.

Other passive defense TMD programs in the Defense Department are less identifiable; overall funding appears to be negligible. Some question whether sufficient attention is paid to the issue. Another question is whether greater interservice coordination should be required. Because active defenses tend to dominate the TMD agenda, passive defense programs may be a TMD mission area that is overlooked.

## COUNTERFORCE OPERATIONS INITIATIVES

This mission area consists largely of efforts to take advantage of existing conventional military systems and operations to prevent missiles from being launched in the first place. All U.S. offensive forces, including space, air, ground, maritime, and special operations forces may be able to destroy missile launch platforms, and support and missile storage facilities. For example, naval cruise missiles or Army tactical missiles could be targeted against enemy theater missile systems, facilities, and storage depots. Special operations forces could

---

[51] See Israel to Study Theater Missile Boost Phase Intercept for SDIO. Aerospace Daily, December 7, 1992. p. 354.

[52] See for example, Lt. Gen. Robert D. Hammond. Statement on Army's Role in Theater Missile Defense. Hearings before the House Armed Services Committee, Subcommittee on Research and Development. May 6, 1992. pp. 6-7.

be used for intelligence gathering, spotting for regular ground and air operations forces, or be used to destroy key enemy missile facilities themselves. Reconnaissance satellites can facilitate targeting requirements.

Within the Air Force, one can find a level of effort directed toward counterforce TMD operations. Reportedly, the Air Force is looking to airborne sensor platforms such as the Joint STARS and AWACS planes to provide surveillance, warning, and identification of missile target locations. Air Force F-15E fighters with precision strike weapons can then be used to target enemy theater missile assets.

Beyond this, however, few new initiatives or programs specifically for this mission have been identified. A key question that can be raised is whether the services are actively pursuing studies, and whether their efforts could be more effective if pursued in a more coordinated and integrative manner. It also remains uncertain how much priority TMD counterforce operations will receive by the theater commander in any future conflict where the threat of missile attacks is great. Finally, it remains unclear whether such operations will be highly successful in wartime. The Desert Storm experience was considered disappointing in this regard. Allied forces were simply unable to destroy Iraqi mobile missile launchers and other facilities despite numerous ideal opportunities.

## $C^3I$ INITIATIVES

### Near- and Mid-Term Efforts

One of the challenges TMD systems present military planners is integration and coordination of TMD with other theater military operations. Several initiatives are underway or planned. For example, both the Army and the Navy are actively seeking to tie the various TMD technologies and systems together.[53] The Army TMD $C^3I$ further takes advantage of existing systems used for Air Defense and Counterforce.[54] Airborne and space-based sensors can be used to supplement these systems as well. The DSP (Defense Support Program), for example, is now upgrading its existing sensor array to permit tactical (in-theater) processing and improve data dissemination. All these programs can give theater commanders the information they require to consider appropriate TMD responses with the TMD resources they have in hand.

The Army and the Navy are also looking to upgrade an array of existing sensor systems to deal with the threat of theater missile attacks and to assist

---

[53] Sea-Based Theater Missile Defenses. p. 7.

[54] Ibid.

in the TMD mission.[55] Another program seeks to figure out how to integrate fighter aircraft functions and operations with surface-to-air missiles in a more effective way. The Joint Air Defense Operations/Joint Engagement Zone program office is doing this work. Other programs may be underway, but they are difficult to uncover.

Some $C^3I$ initiatives appear fairly prominently in the public debate and literature. These are primarily radar upgrade programs pursued in conjunction with other interceptor upgrade programs. Two of these are described below.

### *Aegis Spy-1 Radar*

Various software modifications are being made to the Aegis Spy-1 radar and the shipboard weapon control system. When completed, this will provide the Navy's upgraded SM-2 Block IV interceptor the ability to detect theater missile launches, and track and engage them. The Navy expects this will give them a near-term capability comparable to the Patriot PAC-3 system. These upgrades are expected to be completed in FY 1996-FY 1999.

### *TPS-59 Radar*

The Marines are changing the software on their TPS-59 radar system in conjunction with their Hawk upgrade plans. The Marines believe they will be able to provide TMD warning, tracking, and surveillance for the Hawk system. The Marines state this would allow them pick up attacking missiles from about 400 nautical miles and up to 500,000 feet. Production of the radar is scheduled to begin in mid-FY 1995.

## Long-Term Programs

### *TMD-GBR Radar*

Program Description

The TMD-GBR (Theater Missile Defense-Ground Based Radar) will play a central role in the drive to deploy effective TMD systems. This radar will be transportable (in C-130 aircraft), and will be designed to detect, identify, and track theater missiles of all ranges. The radar itself is intended to provide high resolution of objects at high altitudes (the drawback to this is that it will likely require some cuing from space-based sensors, such as Brilliant Eyes). When completed, the TMD-GBR is planned to provide fire control and kill assessments to THAAD battalions. It will also serve to cue Patriot and ERINT batteries.

In September 1992, this radar entered the dem/val phase. A team lead by Raytheon won the contract. In late FY 1996, two prototype radars will be

---

[55] See, Schoenfeld, Bruce. Air Force Missile Defenses Focus on Launchers. Defense Week. Feb. 18, 1992. p. 3.

available to support the THAAD UOES. Production of the radars is expected after the year 2000.

### *Brilliant Eyes*

Program Description

Brilliant Eyes would consist of a system of several dozen light-weight, low-cost space-based sensors (or satellites) deployed at medium altitudes. These sensors would provide surveillance of ballistic missile attacks in coordination with a network of space- and ground-based interceptors and ground-based radars. Brilliant Eyes would also support peacetime surveillance missions. The Brilliant Eyes would be designed to provide global coverage.

Projected Capability

Brilliant Eyes is being designed so that it could contribute to TMD in several ways. First, by providing theater-wide surveillance and launch detection. Upon notification by U.S. early warning satellites of a missile attack (or launch) from anywhere on the earth, Brilliant Eyes sensors would locate and track the target through the mid-course of its flight trajectory. Second, Brilliant Eyes would be designed to cue TMD radar systems. Brilliant Eyes would maintain surveillance and observe whether multiple warheads or decoys were released from the attacking missile. All data on the missile's launch point, likely impact, and on warheads or decoys would be transmitted to ground stations, where command and control facilities could launch appropriate interceptors. Third, Brilliant Eyes would be designed to support rapid deployment forces and naval TMD systems.

As part of the GPALS concept, Brilliant Eyes are planned for use in conjunction with TMD systems to improve their capabilities. Brilliant Eyes is expected to provide TMD interceptor systems earlier, multiple opportunities to engage and destroy attacking missiles.

Program Status and Projected Milestones

In December 1992, the Pentagon awarded Rockwell International and a team of Hughes and TRW five-year contracts for the demonstration and validation phase of Brilliant Eyes. The contracts call for development of the satellite and sensor system's design, flight demonstrations, ground system design, and ground demonstrations of key technologies.

The program goal is to have the system operational by about the year 2002, so that it can support deployment of a National Missile Defense against strategic ballistic missiles and more advanced TMD systems.

Program Cost

Official cost estimates for the Brilliant Eyes system are about $5 billion. This includes the GPALS requirement for Brilliant Eyes, which would support TMD, NMD, and GPS.

# GLOSSARY

**Air defense:** All measures designed to destroy attacking enemy aircraft or cruise missiles within the earth's atmosphere, or to nullify the effectiveness of such an attack.

**ABM (Anti-Ballistic Missile) Treaty:** A Treaty of 1972, signed and ratified by the Soviet Union and the United States, prohibiting development of many types of antiballistic missile systems and limiting deployments on each side to 100 land-based interceptors and associated radars. TMD systems are not specifically constrained by the Treaty.

**Ballistic missile:** A guided vehicle propelled into space by rocket engines. Thrust is terminated at a predesignated time after which the missile's reentry vehicles are released and follow free falling trajectories toward their ground targets under the influence of gravity. Much of a reentry vehicle's trajectory will be above the atmosphere. Less sophisticated ballistic missiles will not have a separate reentry vehicle (e.g., the Iraqi-modified Scuds used in the 1991 Persian Gulf war). The entire missile will therefore follow a free falling trajectory.

**Ballistic missile defense (BMD):** A defensive system designed to intercept and destroy a ballistic missile or its reentry vehicle, or both, during any portion of the missile's flight.

**Global Protection Against Limited Strikes (GPALS):** GPALS is a limited global missile defense concept adopted under the Bush Administration. GPALS would consist of three components: (1) TMD systems are planned for concurrent development and deployment with a (2) National Missile Defense (NMD) of the United States. These two components would be deployed before (3) a Global Protection System (GPS). Bush Administration plans called for the deployment of near-term TMD systems during the mid-to-late 1990s and advanced TMD capabilities in the latter 1990s. After the year 2000, these and other more advanced TMD systems would be augmented with space-based sensors (called Brilliant Eyes) and integrated with space-based interceptors (called Brilliant Pebbles) to form a broader, global TMD capability as part of the GPALS system.

**Global Protection System (GPS):** Generally, GPS refers to the space-based portion of the GPALS concept. It would consist of several dozens of space-based sensors (Brilliant Eyes) and hundreds of space-based interceptors (Brilliant Pebbles). It is considered the most controversial element of GPALS.

**INF (Intermediate Nuclear Forces) Treaty:** A Treaty of 1987, signed and ratified by the Soviet Union and the United States, eliminating all intermediate-range (500 kilometers to 5,500 kilometers) missile systems.

**Missile Defense Act (MDA) of 1991:** As part of the Defense Authorization Act, the MDA is a congressional mandate to deploy effective TMD systems as soon as possible. As amended in 1992, it directs the Secretary of Defense to develop for deployment, a cost-effective, operationally effective, and ABM Treaty compliant ABM system...designed to protect the United States against limited ballistic missile threats, including accidental or unauthorized launches or Third World attacks.

**Missile Technology Control Regime (MTCR):** A set of guidelines adopted by Canada, the United Kingdom, Germany, France, Italy, Japan, the United States, and fifteen additional countries, pledging each nation to work to prevent the further spread of missiles and missile technology throughout the world.

**National Missile Defense (NMD):** That portion of the GPALS system that would protect the United States from limited long-range missile attacks. Under the GPALS concept, the NMD could consist of one missile defense site with 100 ground-based interceptors, or it could consist of many sites with hundreds of missiles.

**Reentry vehicle (RV):** The part of a ballistic missile that carries the missile's warhead to its target. The RV is designed to reenter the earth's atmosphere in the final or terminal portion of its trajectory and proceed to its target.

**Theater missile:** Includes ballistic missiles, air-breathing cruise missiles, or air-to-surface guided missiles whose target is within a theater or such missiles that are capable of attacking targets within a theater or region.

**Theater Missile Defense (TMD):** A defensive system designed to protect territory or other specific assets from attacking theater missiles armed with conventional or weapons of mass destruction warheads.

**Warhead:** A weapon contained in the reentry vehicle of a missile or in the payload of the missile itself.